UNITED STATES PATENT APPLICATION

OF

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FOR

MAGNETIC BRAKE FOR BRAKING A LINE SPOOL OF A FISHING REEL

Field of the Invention

The present invention relates to an induction type magnetic brake for braking a line spool of a fishing reel.

A magnetic brake of this type is used for braking the line spool during casting, thereby to prevent rotation of the line spool at a speed higher than the pay-out speed of the line, which usually results in backlash with consequent tangling of the line.

Background Art

A magnetic brake of this type is known from, for instance, US Patent No. 4,580,742. This known magnetic brake has a plurality of permanent magnets for inductive cooperation with the line spool and a magnet support carrying the magnets. In this known magnetic brake, the braking effect of the brake on the line spool is controlled like in most prior-art magnetic brakes of this kind by the magnet support being displaced in the axial direction of the line spool shaft. This displacement is brought about by turning an adjusting knob. When the braking effect of the brake on the line spool is to be increased, the magnet support is displaced towards the line spool, and when this braking effect is to be reduced, the magnet support is displaced away from the line spool. If a reasonable adjusting range of the braking effect of the magnetic brake on the line spool is to be obtained, the range of displacement of the magnet support

must be fairly great, and consequently the magnet support must be given a large space in the fishing reel, at least seen in the axial direction. This requires, in turn, that the fishing reel be given large dimensions. A further drawback is that the magnetic brake exerts a certain braking effect on the line spool even when the magnet support is displaced to its position furthest away from the line spool, i.e. the braking effect cannot be fully canceled.

Summary of the Invention

The object of the present invention is to provide a magnetic brake, which requires but little space and thus makes it possible to reduce the axial extent of the fishing reel and the construction of which makes it possible to easily completely cancel the braking effect of the magnetic brake on the line spool.

According to the invention, this object is achieved by an induction type magnetic brake for braking a line spool of a fishing reel having a frame, in which the line spool is supported rotatably about an axis of rotation, and two side plates which are mounted on the frame, the line spool having a end wall fixedly connected thereto and extending perpendicular to the axis of rotation, said magnetic brake having a plurality of permanent magnets for inductive cooperation with the end wall of the line spool and a magnet support carrying the magnets and located between one of said side plates and the end wall

of the line spool, said magnetic brake being characterized in that

the magnet support carries the magnets in a first plane perpendicular to the axis of rotation, and

a shielding plate is arranged in a second plane which is perpendicular to the axis of rotation and located between the first plane and the end wall of the line spool, the magnet support and the shielding plate being movable perpendicular to the axis of rotation and relative to each other to different relative positions, in which the shielding plate covers the magnets to different degrees.

In a preferred embodiment, the magnet support and the shielding plate are movable perpendicular to the axis of rotation and relative to each other between a first relative position, in which the shielding plate is positioned straight in front of the magnets and completely shields the magnets in order to cancel their inductive cooperation with the end wall of the line spool, and a second relative position, in which the shielding plate is moved aside and completely uncovers the magnets.

The magnet support and the shielding plate are suitably turnable about the axis of rotation relative to each other to their different relative positions. In this case, the magnet support preferably carries the magnets in such a manner that they are located at essentially the same radial distance from the axis of rotation.

An operating means, which is turnable about an axis parallel to the axis of rotation, is advantageously mounted on said one side plate and operable from the outside thereof and has a first tooth element meshing with a second tooth element which is arranged on one of the magnet support and the shielding plate, for providing, on turning of the operating means, relative turning of the magnet support and the shielding plate about the axis of rotation.

The magnet support is preferably attached to said one side plate while the shielding plate is movable perpendicular to the axis of rotation.

Brief Description of the Drawings

The invention will now be described in more detail by means of a preferred embodiment and with reference to the accompanying drawings, in which

Fig. 1 is a longitudinal section along line I-I in Fig. 2 and shows a fishing reel provided with a magnetic brake according to the present invention, the magnetic brake being shown in a first position;

Fig. 2 is an end view and shows the fishing reel in the direction of arrow II in Fig. 1;

Fig. 3 is an exploded view and shows some of the components of the fishing reel shown in Fig. 1;

Fig. 4 is an end view and shows the components shown in Fig. 3 in an assembled position in the direction of

arrow IV in Fig. 3, the magnetic brake being shown in its first position according to Fig. 1;

Fig. 5 corresponds to the Fig. 4 but shows the magnetic brake in a second position; and

Fig. 6 is a perspective view and shows the components shown in Figs 4 and 5 from the opposite side, the side plate, the left one in Fig. 1, of the fishing reel being removed.

Description of a Preferred Embodiment

The multiplier type fishing reel shown in Fig. 1 has a frame 1, two side plates 2 and 3, a line spool 4 mounted in the frame 1 for receiving a line (not shown) and a foot 5 for mounting the fishing reel on a fishing rod (not shown).

The right side plate 3, which will not be described in detail here, is screwed to the frame 1. The left side plate 2 consists of a cap-shaped outer part 2a and a cap-shaped inner part 2b, to which the outer part 2a is snapped on. The inner part 2b is attached by means of screws 6 (Fig. 3) to a mounting plate 7 which in turn is screwed to the frame 1.

A line spool shaft 8 is at its one end inserted into a cup-shaped sleeve 9 which is fixed in the right side plate 3, and at its other end inserted into a cup-shaped sleeve 10 extending through the mounting plate 7. The sleeve 10 is non-rotatably but axially displaceably mounted in a through hole 11 (Fig. 3) in an externally

threaded hub portion 7a projecting to the left and positioned on the mounting plate 7, the bottom end of the sleeve 10 extending beyond the mounting plate. A compression spring 12 is arranged in the sleeve 10 between the bottom thereof and the end of the line spool shaft 8.

The line spool 4 is rotatably supported on the shaft 8 by means of two ball bearings 13 and 14 which are mounted a distance into the line spool 4 in a central through opening 15 in the same. The line spool 4 is rotatable about the axis of rotation A defined by the line spool shaft 8. A friction washer 16, which is non-rotatably connected to the line spool 4, is arranged in the central opening 15 axially outside the left ball bearing 13. A sleeve 17 is fixed to the shaft 8 axially outside the ball bearing 14.

A coupling means in the form of a toothed coupling sleeve 18 is rotatably and axially displaceably mounted on the shaft 8. The coupling sleeve 18 meshes at its right end with a drive gear 19 which is non-rotatably mounted on a drive shaft 20 which is rotatable by means of a handle (not shown). The coupling sleeve 18 is shown in Fig. 1 in a coupling position, in which the left end thereof is in prior-art manner drivingly engaged with a coupling ring 21 non-rotatably connected to the line spool 4. When a cast is to be made, the coupling sleeve 18 is displaced in prior-art manner by means of an operating key (not shown) to the right to a disengaged

position, in which it is drivingly disengaged from the coupling ring 21. When the coupling sleeve 18 is in its disengaged position, the line spool 4 can rotate freely on the shaft 8. When starting to rotate the handle in the direction of retrieval, i.e. the direction in which that part of a line fixed to the line spool 4 which has been reeled out during casting, is again wound onto the spool, the coupling sleeve 18 is in prior-art manner automatically returned to its coupling position for rotating the line spool 4.

The fishing reel has a mechanical brake for braking the line spool 4 during casting. This mechanical brake, whose braking effect on the line spool 4 is independent of the speed of rotation thereof and which comprises the friction washer 16 and the cup-shaped sleeve 10, is adjustable with the aid of an adjusting means in the form of a cup-shaped sleeve 22 which is internally threaded and screwed to the hub portion 7a of the mounting plate 7. A disk 23 made of an elastic material, such as rubber, is placed in the sleeve 22 and abuts against the bottom thereof. The sleeve 22 is arranged to press, by way of the disk 23, the sleeve 10 into frictional engagement with the friction washer 16. The power by which the sleeve 10 is pressed against the friction washer 16 and, thus, the braking effect of the mechanical brake on the line spool 4 are adjusted by rotation of the sleeve 22. The sleeve 22 is rotated with the aid of an operating

means in the form of an adjusting knob 24, which is mounted in the left side plate 2 and turnable about an axis parallel to the axis of rotation A. The adjusting knob 24 has an outer first toothing 25 which meshes with an outer toothing 26 of the sleeve 22, thereby, in turning of the adjusting knob 24, making the sleeve 22 rotate for adjusting the braking effect of the mechanical brake on the line spool 4.

The adjusting knob 24 is turnable between a first position (MIN), in which it is shown in Fig. 2 and in which the braking effect of the mechanical brake on the line spool 4 is canceled, and a second position (MAX), which differs from the first position in a counterclockwise direction (with respect to Fig. 2) by about 320°, and in which the braking effect of the mechanical brake on the line spool 4 is at its maximum.

The fishing reel also has an induction type magnetic brake for braking the line spool 4 during casting. The line spool 4, which in this example is made of aluminum, has at each end an end wall 4a, 4b perpendicular to the shaft 8. The magnetic brake, whose braking effect on the line spool 4 is dependent on the speed of rotation thereof, has a plurality of permanent magnets 27 for inductive cooperation with the left end wall 4a of the line spool 4. The magnets 27 are carried by an arcuate magnet support 28, which by means of screws 29 is fixed to the mounting plate 7 close to the end wall 4a. The magnet

support 28 is in this example made of a plastic material and has an arcuate recess, whose opening faces the mounting plate 7. The magnets 27 are flat and circular-cylindrical and are arranged in this recess, in which they are kept in place in a first plane perpendicular to the axis of rotation A by an arcuate cover plate 30 made of iron. The magnets 27 are distributed along a circular arc and are thus located at the same radial distance from the axis of rotation A. The magnetic brake has an adjusting means, which consists of a wheel 31 which is turnably mounted on the mounting plate 7 and coaxial with the line spool shaft 8, and, attached to the wheel, an arcuate shielding plate 32 made of iron, which is arranged in a second plane, perpendicular to the axis of rotation A, between the magnets 27 and the end wall 4a of the line spool 4. The wheel 31 has, along part of its circumference, an external toothing 33, which meshes with an external second toothing 34 of the adjusting knob 24. The arcuate recess of the magnet support 28, the arcuate cover plate 30, the arcuate shielding plate 32 and the toothing 33 of the wheel 31 have an extent of about 110°.

When turning the adjusting knob 24, its second toothing 34 makes, by way of the toothing 33, the wheel 31 turn for adjusting the braking effect of the magnetic brake on the line spool 4. When the adjusting knob 24 is in its first position (MIN), the shielding plate 32 is, due to the turning of the wheel 31, in a first position

(Fig. 4), in which it is placed straight in front of the magnets 27 and completely shields the magnets in order to cancel their inductive cooperation with the end wall 4a of the line spool 4. When the adjusting knob 34 is turned to its second position (MAX), the wheel 31 and thus the shielding plate 32 are turned to a second position (Fig. 5), in which the shielding plate is moved aside and completely uncovers the magnets 27.

A desired braking effect on the line spool 4 thus is adjustable by the adjusting knob 24 being turned to a suitable position and both the mechanical brake and the magnetic brake will thus be set in the intended braking position - the mechanical brake by the sleeve 10 being pressed against the friction washer 16 by a force dependent on the turning position of the adjusting knob 24 and the magnetic brake by the shielding magnet 32 shielding the magnets 27 to a degree which is dependent on the turning position of the adjusting knob 24. It should also be noted that the braking effect of the two brakes on the line spool 4 is completely canceled when the adjusting knob 24 is in its first position (MIN). It should further be noted that the adjusting knob 24 with the toothings 25, 34, the sleeve 22 with the toothing 26, the hub portion 7a with its toothing and the wheel 31 with the toothing 33 are arranged in such a manner that turning of the adjusting knob 24 in one direction makes both the sleeve 22 and the wheel 31 turn for increasing the

braking effect of the respective brakes on the line spool 4, and turning of the adjusting knob 24 in the other direction makes both the sleeve 22 and the wheel 31 turn for reducing the braking effect of the respective brakes on the line spool.